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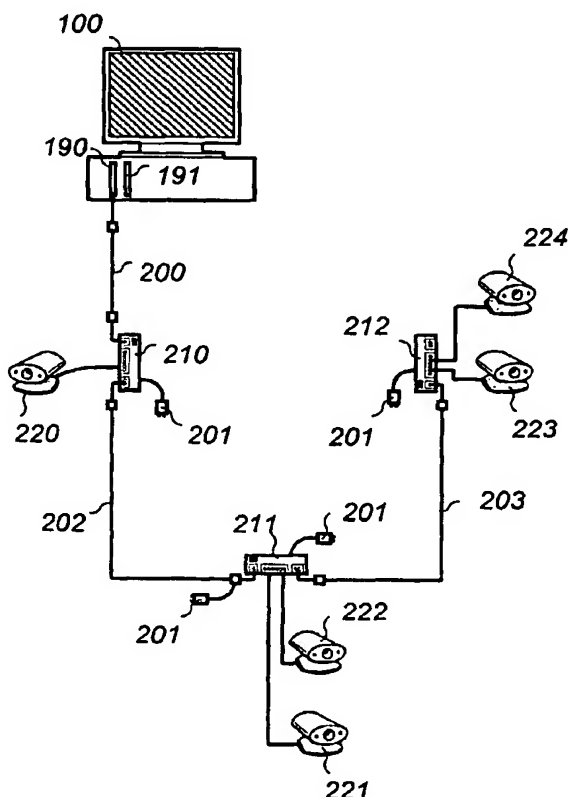
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(54) Title: PC-BASED DIGITAL VIDEO RECORDER SYSTEM WITH A MULTIPLE OF USB CAMERAS



(57) Abstract: The present invention discloses a PC-based digital video recorder (DVR) system processing the digital image data of multi-channels broadcasted from multiple of cascaded USB cameras that are installed at locations up to 50 meters far away from the system. The present invention makes it possible to implement a PC-based DVR system with reduced cost by cascading USB cameras with fiber-optic extension cables and USB hubs for the security and surveillance.

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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

PC-BASED DIGITAL VIDEO RECORDER SYSTEM WITH A
MULTIPLE OF USB CAMERAS

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FIELD OF THE INVENTION

The present invention relates to PC-based digital video recorder system with a multiple of USB cameras, and more particularly to a digital video recorder system that is conveniently applicable to a security and surveillance system with reduced cost by cascading a multiple of USB cameras up to 50 meters.

15

As the industrial structure becomes complicated, the application area of the security and surveillance system monitoring the buildings and offices has been expanded. The digital video recorder(DVR) system is currently used for the surveillance of the building, the underground parking lot, the service desk at the bank, and the automatic teller machine(ATM).

20

According to the prior art of a DVR, as shown in FIG. 1, the main computer unit 100 for storing the digital image has connections with a multiple of analog CCD cameras 121, 122, 123

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through coaxial cables 140, 141, 142, 143.

The images that are captured by each CCD cameras 121, 122, 123 are processed at a hardware, which is called a capture board 110.

5 The DVR system in accordance with the prior art, however, has a shortcoming in a sense that each CCD camera monitoring the security of a specific area should have its own power supply 130, 131, 132, 133 in a separate
10 manner.

In the meanwhile, the capture board 110, which is often called as an encoder in case when a chip for digital image compression is included, comprises a capture chip. The
15 capture chip captures the image data that is sent from an analog CCD camera and stores the image data in the memory through the PCI bus. In this case, the storing process in the memory through the PCI bus is controlled by a
20 DMA(direct memory access).

Thereafter, the image data stored in the memory is accessed by a central processing unit and compressed for digital data storage.

25 In case of the conventional DVR in accordance with the prior art, it is necessary to prepare for a device driver in order to administrate the DMA that stores the digital

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image sent from the capture chip through the PCI bus.

In other words, since the device driver is a software interface that receives the data from the capture chip through the PCI bus, it is inconvenient to prepare for the device driver additionally for implementing the DVR.

In an effort to resolve the problem of the conventional DVR system having analog CCD cameras, an approach has been suggested that employs the USB cameras.

The DVR system equipped with USB cameras, however, suffers from the limit in the practical applications because of the technical problems in cascading a multiple of USB cameras at more than 5 meters distance.

Consequently, the USB camera is usually employed only for personal usage, i.e. chatting camera on Internet.

SUMMARY OF THE INVENTION

Accordingly, it is an object of the present invention to provide a DVR system that can be operated with a multiple of USB cameras in cascade.

It is another object of the present

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invention to provide a DVR system that reduces the cost for the installation by either cascading or directly connecting a multiple of USB cameras.

5 Yet it is another object of the invention to provide a PC-based DVR system that can be operated even without the capture board.

10 It is further an object of the present invention to provide a DVR system that does not require the additional development of the device driver for processing the image data sent from the recording cameras.

15 In accordance with a broad aspect of the present invention, provided is a DVR system configuring a multiple of USB cameras either by cascade or by direct connection.

20 As disclosed in greater detail below, the PC-based DVR with windows operating system and a multiple of USB cameras resolves the issue of the connection distance limit of less than 5 meters, which is due to the voltage drop along the USB cable.

25 The present invention makes it possible to install a multiple of USB cameras at up to 50 meters from the USB port of the computer by employing a fiber-optic extension cable and a USB hub either for cascade or for fiber-optic

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extension.

BRIEF DESCRIPTION OF THE DRAWINGS

5 Further features of the present invention will become apparent from a description of the present invention in conjunction with the accompanying drawings of the preferred embodiment of the invention,
10 which, however, should not be taken to be limitative to the invention, but are for explanation and understanding only.

In the drawings:

FIG. 1 is a schematic diagram
15 illustrating the configuration of the DVR system in accordance with the prior art.

FIGS. 1 and 2 are schematic diagrams illustrating the configuration of the DVR system in accordance with a first embodiment of
20 the present invention.

FIG. 3 is a schematic diagram illustrating the fiber-optic extension cable for USB cameras in accordance with the present invention.

25 FIG. 4 is a schematic diagram of the DVR system in accordance with a second embodiment in accordance with the present

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invention.

DETAILED DESCRIPTION OF THE INVENTION

5 The present invention will be explained
in detail with reference to the accompanying
drawings.

 FIGS. 1 and 2 are schematic diagrams
illustrating the configuration of the DVR
10 system in accordance with a first embodiment of
the present invention.

 Referring to FIG. 2A, the fiber-optic
extension cable 200 for USB port of a personal
computer 100 enables the computer to
15 communicate with USB cameras 220 located up to
50 meters, far away.

 A first embodiment in accordance with
the present invention, as depicted in FIG. 2B,
has a feature that since the DVR system
20 comprises a multiple of USB cameras connected
to a personal computer with windows operating
system, which provides USB application
programming interface(API), it is possible to
build a device-independent DVR system that can
25 process the digital image data sent from the
USB cameras irrespective of the brand diversity
of USB cameras.

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In the meanwhile, USB(universal serial bus) is a plug-and-play interface between a computer and add-on devices such as audio players, keyboards, and cameras. With USB, a new device can be added to a computer without having to add an adapter card or even having to turn the computer off. The maximum length of the USB cable, however, is limited only up to 5 meters for safe USB communication, the present invention introduces a fiber-optic extension cable 200 for USB network.

Referring to FIG. 2B, a fiber-optic extension cable 200 for USB network can be preferably linked to the USB ports 190, 191 at the back of a personal computer.

The fiber-optic extension cable 200 for USB interface comprises a transceiver for converting the USB electrical signal into the optical signal and vice versa and thereby extends the effective communication distance between the computer and add-on device up to 50 meters.

The detailed description of the fiber-optic extension cable will be presented with reference to FIG. 3 later, and the functional block of the DVR system is described in detail with reference to FIG. 2B.

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Referring to FIG. 2B again, electric power 201 is provided at an end of the fiber-optic extension cable 200 for USB interface and the USB hub 210 enables a multiple of USB cameras to be connected.

As a preferred embodiment in accordance with the invention, the USB hub can be supplied with electrical power independently. In other words, a multiple of USB ports are provided at the USB hub 210, as shown in FIG. 2B, and each USB camera is linked to one of the USB port of the USB hub 210.

In addition, when the DVR system in accordance with the present invention is applied to the security and surveillance system, it is necessary to compress and store the digital image data sent from a multiple of USB cameras that are installed here and there for the security.

For the security applications, the fiber-optic extension cable 202 for USB interface in accordance with the present invention can be linked to the USB hub 210 in a cascade connection and thereby a multiple of USB cameras 221, 222 can be connected via USB hub 211.

Consequently, it is possible to cascade

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a multiple of USB cameras 220, 221, 222, 223, 224 by employing a multiple of USB hubs 210, 211, 212 and a multiple of fiber-optic extension cables 200, 202, 203 for USB interface.

Preferably, the distance between the USB port 190, 191 and the USB camera 224 at the destination of the fiber-optic extension cable 200, 202, 203 should not go over the reliable communication distance, i.e. 50 meters.

As a consequence, the present invention resolves the complexity of the configuration of analog CCD cameras with many ports, correspondingly, of the computer in accordance with the prior art by employing only one USB port 190 with a multiple of USB cameras 220, 221, 222, 223, 224.

The present invention makes it possible for up to 127 USB cameras to be connected to a single USB port 190, and furthermore has a feature in a sense that the cost as well as the installation time can be reduced because of the simplicity in cascading the above-mentioned 127 channels in serial connection.

Once the device driver program, which is provided with the Microsoft windows operating system, is installed at the PC-based

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DVR system in accordance with the present invention, neither additional hardware such as a capture board or a capture chip nor software including a device drive for specific brand of camera is required.

FIG. 3 is a schematic diagram illustrating the configuration of the fiber-optic cable for USB interface in accordance with the present invention. The USB bus comprises V_{cc} power line of +5 volts, ground line, D^+ data line, and D^- data line.

Referring to FIG. 3, either D^+ terminal or D^- terminal of the port A of USB is connected to a first control switch 301, and a first driver 302 drives the light-emitting diode 304 with correspondence to the electric signal from the port A 300 for transmitting light signals through the fiber-optic cable 306.

The optical signal is detected at a photodiode 308 and transmitted to a second control switch 312 through the conversion into an electric signal at a second amplifier 310. Similarly, the USB signal from the port B 320 is transferred through a second driver 311 and a light-emitting diode 309 to a fiber-optic cable 307, and the optical data is extracted at the photodiode 305 to be sent to a first

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amplifier 303 and a first control switch 301.

As a preferred embodiment in accordance with the present invention, a conventional cable can be used in place of the fiber-optic extension cable. The detailed description for the fiber-optic extension cable can be referred to the bulletin of the Korean patent applications laid-open No. 2001-0016359.

FIG. 4 is a schematic diagram illustrating the configuration of the DVR system in accordance with a second embodiment of the present invention. A second embodiment in accordance with the present invention provides an embedded DVR system that employs an industrial CPU with its own real-time operating system for the installation of a multiple of USB cameras.

Referring to FIG. 4, an industrial CPU 401, a USB chip 402 in connection with USB, and a USB port 404 are shown. In this case, a USB driver program should be provided.

In the meanwhile, a multiple of USB cameras 408, 409, 410 can be connected to the USB port 404 via the fiber-optic extension cable 405, 407 and a multiple of USB ports 406, 411 by cascade or direct connection.

Although the invention has been

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illustrated and described with respect to
exemplary embodiments thereof, it should be
understood by those skilled in the art that
various other changes, omissions and additions
5 may be made therein and thereto, without
departing from the spirit and scope of the
present invention.

Therefore, the present invention should
not be understood as limited to the specific
10 embodiment set forth above but to include all
possible embodiments which can be embodied
within a scope encompassed and equivalents
thereof with respect to the feature set forth
in the appended claims.

15 Finally, the present invention makes it
possible to implement a digital video recorder
system with a multiple of USB cameras cascaded
up to 50 meters by employing the fiber-optic
extension cable and a USB hub, if any, without
20 the additional hardware like a capture board,
nor with a device driver program.

As a consequence, the installation cost
as well as the price of the DVR system can be
tremendously reduced because the price of the
25 USB camera is cheaper than that of the
conventional analog CCD camera by more than a
fourth.

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WHAT IS CLAIMED IS:

1. A PC-based digital video recorder (DVR)
5 system having a multiple of USB cameras and
processing the digital image data of multi-
channels broadcasted from said multiple of USB
cameras, comprising:

10 a computer, which is installed with
windows operating system, having at least one
USB port;

15 a fiber-optic extension cable for USB
interface, having an interface module for
converting the electrical signal into optical
signal and vice versa in order to increase the
data communication distance between the USB
port and the USB camera; and

20 a multiple of USB cameras being
connected to said USB port either directly or
through said fiber-optic extension cable
wherein either one or a multiple of USB hub
and/or a multiple of said extension cable can
be employed for cascading said multiple of USB
cameras to a single USB port.

25 2. The PC-based DVR system as set forth in
Claim 1 wherein said windows operating system

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comprises an API(application program interface).

3. The PC-based DVR system as set forth in
Claim 1 wherein said computer does not include
5 a capture board in hardware that processes the
digital image data sent from said USB camera.

4. The PC-based DVR system as set forth in
Claim 1 wherein said USB hub comprises a
10 multiple of terminals, each of which is
connected to one of the group of said USB
camera, said fiber-optic extension cable, and
USB cable.

15 5. A PC-based digital video recorder(DVR)
system processing the digital image data of
multi-channels, comprising:

a computer having at least one USB port;

a USB chip processing the USB data
20 transmitted through said USB port;

an industrial CPU, installed at said
computer, driving a real-time operating
system(OS) and said USB chip;

a fiber-optic extension cable for USB
25 interface, having an interface module for
converting the electrical signal into optical
signal and vice versa in order to increase the

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data communication distance between the USB port and the image capturing cameras; and

a multiple of USB cameras being connected to said USB port either directly or through said fiber-optic extension cable wherein either one or a multiple of USB hub and/or a multiple of said extension cable can be employed for cascading said multiple of USB cameras to a single USB port, and a driver program for driving said USB camera is stored in a storage means.

6. The PC-based DVR system as set forth in Claim 1 or Claim 5 wherein a first terminal among said a multiple of terminals of said USB hub is connected to one from the group of a USB port, a cable linked to said USB port, a fiber-optic extension cable linked to said USB port, and a second terminal is connected to said USB camera, while a third terminal is connected to either a cable or a fiber-optic extension cable that is to be cascaded for the link to the next USB cameras.

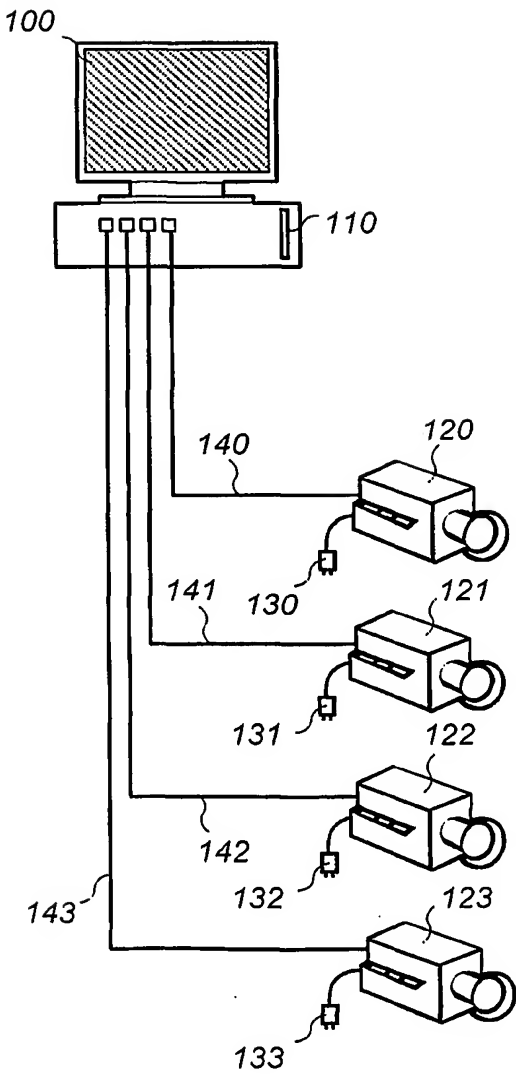
7. The PC-based DVR system as set forth in Claim 1 or Claim 5 wherein the distance between the USB port and the farthest USB camera that

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is connected in a cascaded manner with said USB hub and/or said fiber-optic extension cable lies within the effective length of data communication without failure.

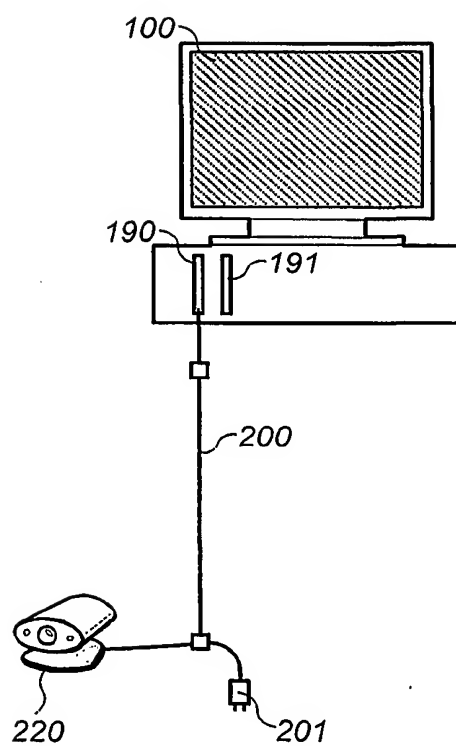
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FIG. 1



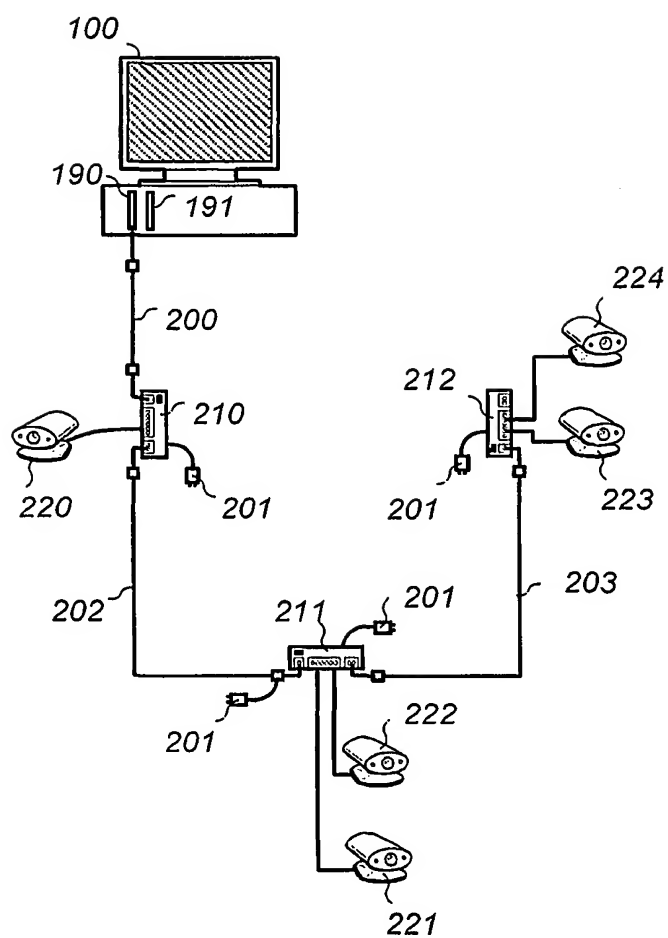
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FIG. 2A



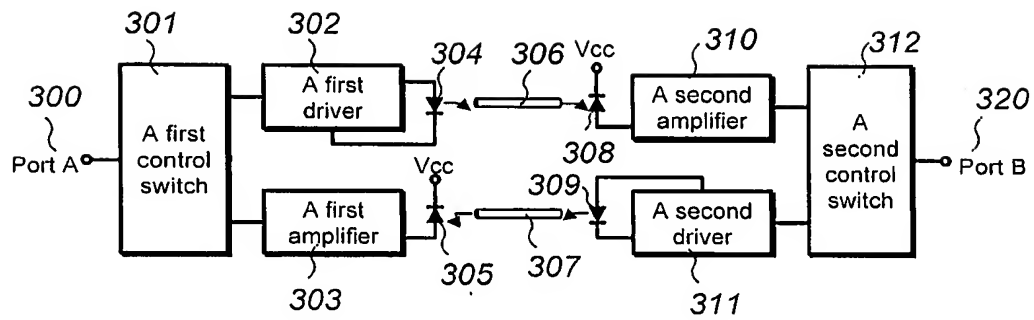
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FIG. 2B



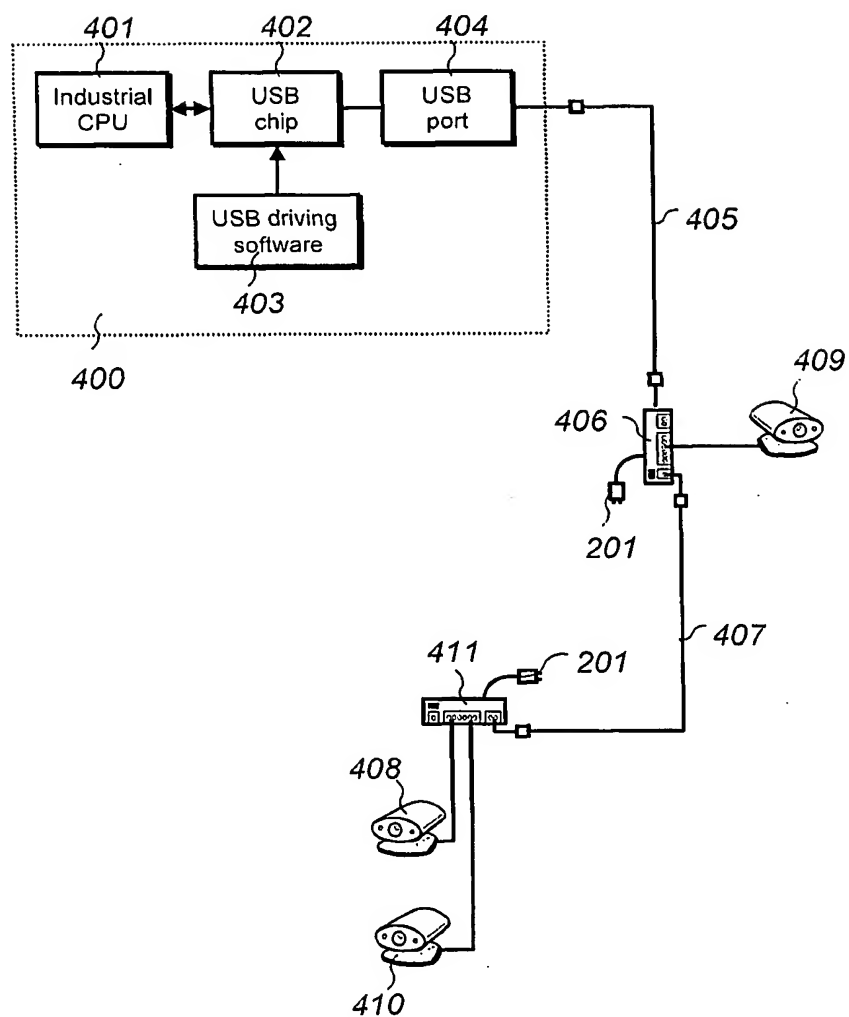
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FIG. 3



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FIG. 4



INTERNATIONAL SEARCH REPORT

International application No.

PCT/KR02/00868

A. CLASSIFICATION OF SUBJECT MATTER

IPC7 H04N 7/18

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7 H04N 7/18

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Korean patents and applications for inventions since 1975, Korean utility models and applications for utility models since 1975.

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 6,049,353 A (Darrell D. Gray) 11 April 2000 see the whole document	1 - 7
A	KR 2000-60779 A (Hynix Semiconductor Inc.) 16 October 2000 see the whole document	1 - 7
A	KR 1996-42319 A (LG Honeywell Co.) 21 December 1996 see the whole document	1 - 7

☐ Further documents are listed in the continuation of Box C.☐ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family


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